

JUL 27 2006

Docket No.: 102323-98

Amendments to Claims

This Listing of the Claims replaces all prior versions, and listings, of claims in this application.

Listing of the Claims:

1-10. (Canceled)

11. (Currently Amended) A method of processing spread spectrum waveforms transmitted by a plurality of users of a spread spectrum system, comprising:

computing a matrix representing cross correlations among the waveforms, said computing step including

performing matrix calculation on at least a first one of two matrix components related by a symmetry property defined in accord with the relation:

$$R_{l,k}(m) = \xi R_{k,l}^*(-m)$$

wherein

$R_{l,k}(m)$  and  $R_{k,l}(m)$  refer to  $(l,k)$  and  $(k,l)$  elements of the cross correlation matrix, respectively, and

$\xi$  is a proportionality constant,

computing a second one of the two matrix components as a function of the first matrix component by applying said symmetry property, and

generating estimates of symbols transmitted by the users and encoded in said waveforms as a function of the cross correlation matrix

wherein the step of computing the cross-correlation matrix comprises computing a matrix (herein referred to as  $\Gamma$ -matrix) that represents correlations among short code sequences associated with the respective users in accord with the relation:

$$\Gamma_{ik}[m] = \frac{1}{2N_i} \sum_{n=0}^{N-1} c_i^*[n] \cdot c_k[n-m]$$

wherein

$c_i^*[n]$  represents complex conjugate of the short code sequence associated with the  $i^{\text{th}}$  user,

$c_k[n-m]$  represents the short code sequence associated with  $k^{\text{th}}$  user,

$N$  represents the length of the code, and

$N_i$  ~~represents~~ represent the number of non-zero length of the code

wherein the step of computing the cross-correlation matrix comprises computing a matrix (herein referred to as C matrix) representing cross-correlations among time lags associated with the transmitted waveforms and correlations among the short code sequences of the respective users as a function of the  $\Gamma$ -matrix in accord with the relation:

$$C_{ikqq}[m] = \sum_m g[mN_c + \tau] \cdot \Gamma_{ik}[m]$$

wherein

$g$  is a pulse shape vector,

$N_c$  is the number of samples per chip,

$\tau$  is a time lag,

$m$  is a symbol period, and

$\Gamma$  represents the aforesaid  $\Gamma$  matrix.

12. (Currently Amended) The method of claim 11, wherein the step of computing the cross-correlation matrix (herein referred to as r-matrix) ~~comprises~~ comprising calculating the r matrix as a function of the C matrix in accord with the relation:

$$r_{lk}[m] = \sum_{q=1}^L \sum_{q'=1}^L \operatorname{Re} \left\{ \hat{a}_{lq}^* a_{kq'} \cdot C_{lkqq'}[m] \right\} = \operatorname{Re} \left\{ a_l^H \cdot C_{lk}[m] \cdot a_k \right\}$$

wherein

$\hat{a}_{lq}^*$  is an estimate of  $a_{lq}^*$  which is the complex conjugate of one multipath amplitude component of the  $l^{\text{th}}$  user,

$a_{kq'}$  is one multipath amplitude component associated with the  $k^{\text{th}}$  user, and

$C$  denotes the aforesaid  $C$  matrix

$m'$  is an index, indicating a symbol period,

$\operatorname{Re}$  denotes the real part of a complex expression, and

$a_k$  is a columnar matrix representing multipath amplitude components associated with the  $k^{\text{th}}$  user.

13. (Original) The method of claim 12, further comprising the step of computing detection statistics corresponding to the transmitted symbols as a function of the  $r$  matrix.

14. (Original) The method of claim 13, wherein the step of computing detection statistics comprises performing calculation in accord with the relation:

$$y_l[m] = r_{ll}[0]b_l[m] + \sum_{k=1}^{K_v} r_{lk}[-1]b_k[m+1] + \sum_{k=1}^{K_v} [r_{lk}[0] - r_{ll}[0]\delta_{lk}]b_k[m] + \sum_{k=1}^{K_v} r_{lk}[1]b_k[m-1] + \eta_l[m]$$

wherein

$y_l[m]$  represents detection statistic for the  $m^{\text{th}}$  symbol transmitted by  $l^{\text{th}}$  user,

$r_{ll}[0]b_l[m]$  represents a signal of interest, and

the remaining terms represent Multiple Access Interference (MAI) and noise.

15. (Original) The method of claim 14, further comprising the step of generating estimates corresponding to the transmitted symbols by applying a multi-stage decision-feedback interference cancellation (MDFIC) algorithm to the detection statistics.
16. (Original) The system of claim 15, wherein the step of applying the MDFIC algorithm comprises utilizing the relation:

$$\hat{b}_l[m] = \text{sign} \left\{ y_l[m] - \sum_{k=1}^{K_u} r_{lk}[-1] \hat{b}_k[m+1] - \sum_{k=1}^{K_u} [r_{lk}[0] - r_{ll}[0] \delta_{lk}] \hat{b}_k[m] - \sum_{k=1}^{K_u} r_{lk}[1] \hat{b}_k[m-1] \right\}$$

wherein

$\hat{b}_l[m]$  represents an estimate of the  $m^{\text{th}}$  symbol transmitted by the  $l^{\text{th}}$  user.

17-20. (Canceled)